

Contest 2 Prob Review

- ✓ 1) Recycle - Anup
- ✓ 2) Excellence - Brygida
- ✓ 3) K Sums - Anup
- ✓ 4) Locks - Justin
- ✓ 5) Triangles - Justin
- ✓ 6) Pairs - Anup
- ✓ 7) Flower - Brygida
- ✓ 8) Garden - Brygida
- ✓ 9) Merge - Justin
- 10) Divisible - Anup

1) Recycle

Add up 1st 16 #s - TRUE STORY!

2) Excellence

1 2 4 5 6 7

K Sum Sorting

$$k=3$$

2 6 3 4 5 12 6 9 3

$$n=10^5$$

quickly get sum $k=50,000$

1) Prefix sums re-adding

2) sliding window $\rightarrow (50,000)^2$

$$S = S - a[i] + a[i+k]$$

Sum: most $\rightarrow$ least
Index: least $\rightarrow$ most

Locks

Password = 1234

Try:

1212 $\rightarrow$ First 2 digits correct

Known

1 2

Unknown

↑

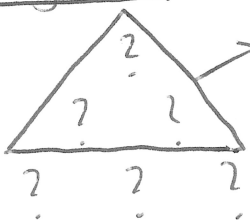
Partially Known

123 X

126 X

$$\{0-2\}, \{4,5\}, \{7-9\} = 8$$

Triangles



Sum of all 3 elements must be divisible by 3



3 solutions



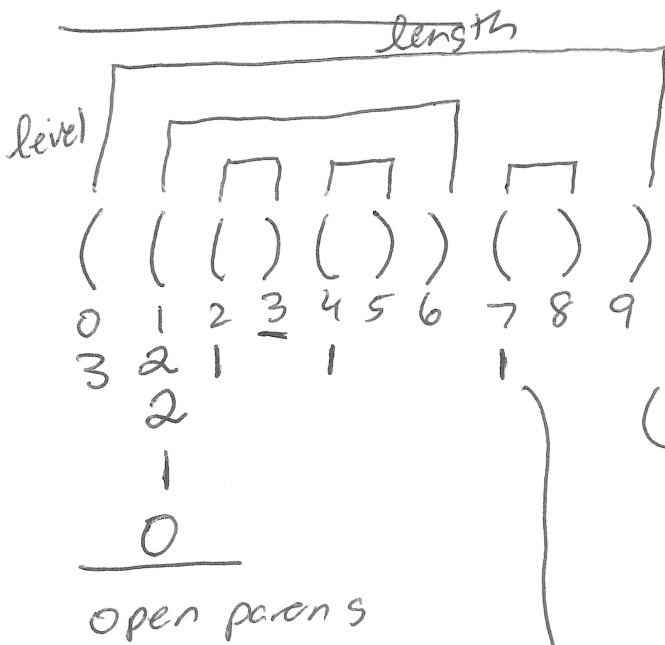
6 solutions

Check all 9 possibilities!

You can use $\{1, 2, 3\}$

$$a \neq b, b \neq c, a \neq c$$

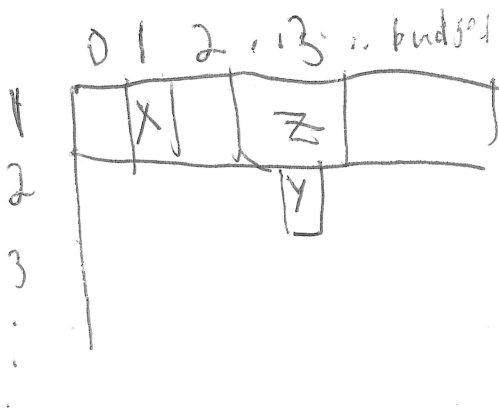
Parentheses



Use stack for open parens
 → PUSH
 CLOSE → POP
 When $pop\ curIdx - popIdx = length(horizontal)$
 → ADD $2 \times depth$ (depth)

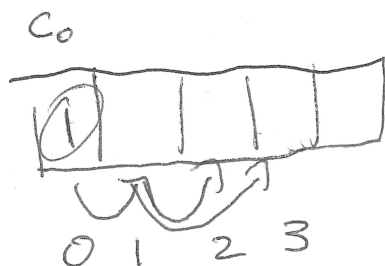
Flower

weight, gain



Garden

1 3 4 9 7



~~if a is prime $(2, K)$:~~

$a = 2$

while $(a * a \leq K)$:

$$f(0) = \min \begin{cases} c_1 + f(1) \\ c_2 + f(2) \\ c_3 + f(3) \end{cases}$$

```
f(int pos) {
    if (memo[pos] != -1)
        return memo[pos]
    res = MAX
    for j : jumps
        res = min(res,
res f(postj)
            + c(postj) )
    return res
    memo[pos] = res
}
```

Merge

Given n numbers x_i ($1 \leq x_i \leq 10,000$)
 $\nwarrow$
 $[1, 100]$

Round $i \rightarrow k = i + 1$

Any 2 numbers a & b s.t. $a \cdot k = b$

$\rightarrow$ Combine the sets of a & b

① $1, 2, 3, 4, 6$

① $\{1, 2, 4\}, \{3, 6\} \rightarrow 2$
 $+$

② $\{1, 2, 3, 4, 6\} \rightarrow 1$
 $= 3$

for (int $k = 2$; $k \leq 10000$; $k++$) $\{ \rightarrow 10,000$

for (int $b = k$; $b \leq 10,000$; $b += k$) $\{ \rightarrow k=2, \rightarrow 5000$

int $a = b/k$

$k=3 \rightarrow 3,333$

$k=4 \rightarrow 2,500$

// keep track of rounds, used, etc...

merge(a, b)

}

}

$$10000 \left(1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \dots \right)$$

$\rightarrow$ For n terms, sum is $\approx \ln(n)$

Divisible Quest

Subsets of $\{1, 2, 3, \dots, n\}$

How many are divisible by d ?

Small

$$n \leq 20$$

$$d \leq 10$$

Large

$$n \leq 10^5$$

$$d \leq 1000$$

SOL

go through all subsets add up sum, add to counter if divisible by d .

2^n subsets $2^{100,000}$ too much

$\{1, 2, 3, 4\}$ $d = 6$

What info do I need to know about these 2^4 subsets to calculate answers about the 2^5 subsets of $\{1, 2, 3, 4, 5\}$

Of these 16 subsets we need to know how many ~~are~~ have sums of $0 \bmod 6, 1 \bmod 6, 2 \bmod 6, \dots, 5 \bmod 6$

$\begin{array}{r} 0 \\ * 1 \\ + 2 \\ \hline 3 \checkmark \\ 4 \checkmark \\ 5 \checkmark \\ 6 \checkmark \\ * 7 \checkmark \\ + 8 \\ \hline 9 \\ 10 \end{array}$

$\begin{array}{c} \text{prev} \begin{array}{|c|c|c|c|c|} \hline 0 & 1 & 2 & 3 & 2 \\ \hline 3 & 3 & 2 & 3 & 2 \\ \hline \end{array} \end{array}$

$\begin{array}{c} \text{cur} \begin{array}{|c|c|c|c|c|} \hline 3 & 3 & 2 & 3 & 2 \\ \hline 6 & 5 & 5 & 6 & 5 \\ \hline \end{array} \end{array}$

$\begin{array}{c} \text{init} \begin{array}{|c|c|c|c|c|} \hline 1 & 0 & 0 & 0 & 0 \\ \hline \end{array} \end{array}$

$n=0$

$$\text{cur}[(i+j) \% d] = (\text{cur}[(i+j) \% d] + \text{prev}[j]) \% d$$